

What is claimed is;

1. A liquid crystal display device comprising:

an illumination device,

5 a light control element arranged at ^a projected light side of said illumination device,

^A a reflective polarizer arranged at ^{an} upper portion of

^A said light control element so that ^{the} transmission axis of

^A polarized light is adjusted ^{so} as to increase the

10 transmission rate of the projected light from said illumination device,

a liquid crystal display element for controlling polarization of projected light projected from said reflective polarizer, and

^A 15 a screen arranged at ^{an} upper portion of said liquid crystal display element.

2. A liquid crystal display device as claimed in claim 1, wherein

^A 20 said reflective polarizer is arranged so that ^{the} polarized light transmission axis of said reflective polarizer is approximately in parallel with a major axis direction of ^a pixel of said liquid crystal display element.

25 3. A liquid crystal display device as claimed in claim 2, wherein

^A said reflective polarizer is composed so as to have ^{the} directivity of the light ⁱⁿ a minor axis direction of

said pixel, and

said screen is composed so as to broaden the projected light in the minor axis direction of said pixel.

5 4. A liquid crystal display device as claimed in claim 3, wherein

said reflective polarizer is composed so that said polarized light transmission axis is arranged approximately perpendicularly to light control axis of
A 10 said light control element.

5. A liquid crystal display device as claimed in claim 4, wherein

said screen is composed so as to absorb external light and to transmit the projected light from said
A 15 illumination device.

6. A liquid crystal display device as claimed in claim 1, further comprises:

A 20 a birefringent medium arranged between said illumination device and said light control element.

7. A liquid crystal display device as claimed in claim 1, wherein

25 said liquid crystal display element comprises:
at least a pair of transparent substrates,
a liquid crystal layer interposed between said pair of transparent substrates, and

A pair of absorption type polarizers arranged so that said pair of transparent substrates are held between them.

5 8. A liquid crystal display device as claimed in claim 1, wherein

said illumination device comprises:

a flat shaped waveguide,

a light source arranged adjacently to said waveguide,

10 a reflector composed of numerous depressed planes, protruded planes, or steps, each of which have slightly declined planes, at rear of light projecting plane of said waveguide, and

A a reflector at rear of said waveguide directly or via an air layer, further wherein

15 said waveguide and said light source are composed so that the projected light from said light source is propagated in said waveguide and projected from the light projecting plane of said waveguide, and

20 said declined planes of said reflector are manufactured to be mirrors.

9. A liquid crystal display device as claimed in claim 1, wherein

A 25 said light control element is any of an isotropic medium and a uniaxial birefringent medium.

10. A liquid crystal display device as claimed in claim

A 2, further ^{comprising} ~~comprises:~~

a reflective color selective layer corresponding to the pixel of said liquid crystal display element.

Sub D3
5 11. A liquid crystal display device as claimed in claim 7, wherein

a half value width of projected light θ_1 (an angular range wherein the brightness becomes 1/2 of the peak value) from said illumination device in at least a certain direction ^{polarizes} ~~satisfies~~ a relationship expressed by the following equation:

$$\theta_1 \leq \sin^{-1}(n \cdot \sin(\tan^{-1}(2d/t)))$$

where,

t: thickness of said transparent substrate,

15 n: refractive index of said transparent substrate, and

d: length of minor side of the pixel of said liquid crystal display element.

Sub D1
20 12. A liquid crystal display device as claimed in claim 10, wherein

said liquid crystal layer, said reflective polarizing selective layer, said absorption type polarizing selective layer, and said reflective color selective layer are arranged so that the viewing angle is broadened in a direction of the stripe direction of said reflective color selective layer.

Sub D3 cont.
13. A liquid crystal display device comprising:

an illumination device,
 a light control element arranged at ^a projected light
 side of said illumination device,

A
 a reflective polarizer arranged at ^{an} upper portion of
 5 said light control element,

A
 a liquid crystal display element for controlling
 polarization of projected light projected from said
 reflective polarizer so that the major axis direction of
^a the pixel is arranged approximately in parallel with a
 10 direction wherein the linearly polarized light component
 of the projected light projected from said illumination
 device is high, and

A
 a screen arranged at ^{an} upper portion of said liquid
 crystal display element.

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14. A liquid crystal display device as claimed in claim
 13, further comprises:

A
 a birefringent medium arranged between said
 illumination device and said light control element.

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15. A liquid crystal display device as claimed in claim
 13, wherein

said illumination device comprises:

a flat shaped waveguide,

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a light source arranged adjacently to said waveguide,

A
 a reflector composed of numerous depressed planes,
 protruded planes, or steps, each of which have slightly
 declined planes, at ^a rear of light projecting plane of said

waveguide, and

A a reflector at ^{said plane} rear of said waveguide directly or via
 A an air layer, ~~further~~ wherein

said waveguide and said light source are composed so
 5 that the projected light from said light source is
 propagated in said waveguide and projected from the light
 projecting plane of said waveguide, and

said declined planes of said reflector are
 manufactured to be mirrors.

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16. A liquid crystal display device as claimed in claim
 13, wherein

A said light control element is any of ^{an} isotropic medium
 A and ^a uniaxial birefringent medium.

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17. A liquid crystal display device as claimed in claim
 13, further comprises:

A a reflective color selective layer corresponding to
 A the ^a pixel of said liquid crystal display element.

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18. A liquid crystal display device as claimed in claim
 13, wherein

said liquid crystal display element comprises:

at least a pair of transparent substrates,

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a liquid crystal layer interposed between said pair
 of transparent substrates, and

a pair of absorption type polarizers arranged so that
 said a pair of transparent substrates are held between

them.

19. A liquid crystal display device as claimed in claim 7, wherein

5 a half value width of projected light θ_1 (an angular range wherein the brightness becomes 1/2 of the peak value) from said illumination device in at least a certain direction ^{satisfies} a relationship expressed by the following equation:

10
$$\theta_1 \leq \sin^{-1}(n \cdot \sin(\tan^{-1}(2d/t)))$$

where,

t: thickness of said transparent substrate,

n: refractive index of said transparent substrate, and

15 d: length of minor side of the pixel of said liquid crystal display element.

20. A liquid crystal display device comprising:

an illumination device,

A a light control element arranged at ^a projected light side of said illumination device,

A a reflective polarizer arranged at ^{an} upper portion of said light control element, wherein ^{the} transmission axis of polarized light is arranged so that a rate of transmission of the polarized light projected from said illumination device is increased,

25 a liquid crystal display element for controlling polarization of projected light projected from said reflective polarizer so that the major axis direction of

Sub D
~~the~~^a pixel is arranged approximately in parallel with a direction wherein the linearly polarized light component of the projected light projected from said illumination device is high, and

A 5 a screen arranged at ^{an} upper portion of said liquid crystal display element.

21. A liquid crystal display device as claimed in claim 20, wherein

10 said illumination device comprises a reflector at its rear plane.

22. A liquid crystal display device as claimed in claim 20, wherein

15 said liquid crystal display element comprises:
 at least a pair of transparent substrates,
 a liquid crystal layer interposed between said pair of transparent substrates, and
 a pair of absorption type polarizers arranged so that said
A 20 ~~a~~ pair of transparent substrates are held between them.